USGS NSF GRIP Opportunity

USGS Center:	Upper Midwest Environmental Sciences Center
Project Title:	Are you really there? Modeling false positives from invasive species monitoring
Project Hypothesis or Objectives:	The USGS currently works with agencies such as the USFWS, USEPA, and state natural resource agencies to develop monitoring programs for invasive species. These programs guide natural resource and ecological management. One monitoring program samples environmental DNA (eDNA), which is the DNA organisms release into their environment. Although often more efficient than traditional sampling methods, eDNA may be present even if a species is not present at a site (e.g., bird feces may contain fish eDNA, thereby potentially leading to a false positive for the fish). Such false positives can cause management agencies to misallocate resources and personal. Our project will elaborate models that estimate the probabilities that sites are occupied by one or more species of interest. These so-called occupancy models may be used to account for both false positives (eDNA detected, but the species is not present) and false negatives (eDNA is not detected, but the species is present) but have not been developed to address both false positives and multiple species. Our results will help to guide management and future monitoring programs. Monitored species include Asian carps, sea lamprey, and the New Zealand mud snail.
Duration:	8 months
Internship Location:	La Crosse, WI
Area of Discipline:	Applied Mathematics, Computational Biology, Computer Science, Ecology, Fisheries, Molecular Ecology, or Statistics
Expected Outcome:	The project will develop an algorithm for estimating presence of multiple species at sampling sites under the assumptions of false negatives and false positives. The USGS will benefit from the algorithm proposed under this project. The intern will benefit from participation in an important ecological and natural resource

	management-oriented modeling exercise, and from gaining familiarity with fitting complex occupancy models under a Bayesian paradigm. The intern will also have the opportunity to use the high-throughput computing resources (specifically a USGS HTCondor Flock) as part of the model development processes.
Special skills/training Required:	Familiarity with R, non-linear statistical modeling methods (e.g., logistic regression), and Bayesian assumptions. We will teach the intern how to use Stan (a Bayesian program which may be used to fit occupancy models).
Duties/Responsibilities:	The intern will assist in developing and programing an elaboration of current species occupancy models to address both false positives and multiple species. The model's performance will be evaluated using simulated and observed datasets. The intern will also have the opportunity to share his/her findings with partner agencies such as the USFWS.
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